

1. Work requester fills out this section.

☐ Standing Work Permit

| | | | |
|--|------------------|------------------------|---|
| Requester: Don Lynch | Date: 10/17/2008 | Ext.: 2253 | Dept/Div/Group: PO/PHENIX |
| Other Contact person (if different from requester): Carter Biggs | | | Ext.: 7515 |
| Work Control Coordinator: Don Lynch | | Start Date: 10/20/2008 | Est. End Date: 11/1/08 |
| Brief Description of Work: PC1 West FEM Repair | | | |
| Building: 1008 | Room: IR | Equipment: PC1 West | Service Provider: PHENIX techs & PC experts |

WCC, Requester/Designee, Service Provider, and ES&H (as necessary) fill out this section or attach analysis

| | | | | | |
|---|--|---|--|---|--|
| ES&H ANALYSIS | | | | | |
| Radiation Concerns | | <input checked="" type="checkbox"/> None | <input type="checkbox"/> Activation | <input type="checkbox"/> Airborne | <input type="checkbox"/> Contamination |
| Radiation Generating Devices: | | <input type="checkbox"/> Radiography | <input type="checkbox"/> Moisture Density Gauges | <input type="checkbox"/> Soil Density Gauges | <input type="checkbox"/> X-ray Equipment |
| <input type="checkbox"/> Special nuclear materials involved, notify Isotope Special Materials Group | | | <input type="checkbox"/> Fissionable materials involved, notify Laboratory Criticality Officer | | |
| Safety Concerns | | <input checked="" type="checkbox"/> None | <input type="checkbox"/> Ergonomics | <input type="checkbox"/> Transport of Haz/Rad Material | |
| <input type="checkbox"/> Adding/Removing Walls or Roofs | <input checked="" type="checkbox"/> Confined Space* | <input type="checkbox"/> Explosives | <input type="checkbox"/> Lead* | <input type="checkbox"/> Penetrating Fire Walls | |
| | <input type="checkbox"/> Corrosive | <input type="checkbox"/> Flammable | <input type="checkbox"/> Magnetic Field* | <input type="checkbox"/> Pressurized Systems | |
| <input type="checkbox"/> Asbestos* | <input type="checkbox"/> Cryogenic | <input type="checkbox"/> Fumes/Mist/Dust* | <input type="checkbox"/> Material Handling | <input type="checkbox"/> Rigging/Critical Lift | |
| <input type="checkbox"/> Beryllium* | <input type="checkbox"/> Electrical | <input type="checkbox"/> Heat/Cold Stress | <input type="checkbox"/> Noise* | <input type="checkbox"/> Toxic Materials* | |
| <input type="checkbox"/> Biohazard* | <input checked="" type="checkbox"/> Elevated Work* | <input type="checkbox"/> Hydraulic | <input type="checkbox"/> Non-ionizing Radiation* | <input type="checkbox"/> Vacuum | |
| <input type="checkbox"/> Chemicals* | <input type="checkbox"/> Excavation | <input type="checkbox"/> Lasers* | <input type="checkbox"/> Oxygen Deficiency* | <input type="checkbox"/> Other | |
| * Does this work require medical clearance or surveillance from the Occupational Medicine Clinic? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | | | |
| Environmental Concerns | | <input checked="" type="checkbox"/> None | <input type="checkbox"/> Work impacts Environmental Permit No. | | |
| <input type="checkbox"/> Atmospheric Discharges (rad/non-rad) | <input type="checkbox"/> Land Use | <input type="checkbox"/> Soil Activation/contamination | <input type="checkbox"/> Waste-Mixed | | |
| <input type="checkbox"/> Chemical or Rad Material Storage or Use | <input type="checkbox"/> Liquid Discharges | <input type="checkbox"/> Waste-Clean | <input type="checkbox"/> Waste-Radioactive | | |
| <input type="checkbox"/> Cesspools (UIC) | <input type="checkbox"/> Oil/PCB Management | <input type="checkbox"/> Waste-Hazardous | <input type="checkbox"/> Waste-Regulated Medical | | |
| <input type="checkbox"/> High water/power consumption | <input type="checkbox"/> Spill potential | <input type="checkbox"/> Waste-Industrial | <input type="checkbox"/> Underground Duct/Piping | | |
| Waste disposition by: | | <input type="checkbox"/> Other | | | |
| Pollution Prevention (P2)/Waste Minimization Opportunity: | | <input checked="" type="checkbox"/> None <input type="checkbox"/> Yes | | | |
| FACILITY CONCERNS | | <input checked="" type="checkbox"/> None | | | |
| <input type="checkbox"/> Access/Egress Limitations | <input type="checkbox"/> Electrical Noise | <input type="checkbox"/> Potential to Cause a False Alarm | | <input type="checkbox"/> Vibrations | |
| | <input type="checkbox"/> Impacts Facility Use Agreement | | <input type="checkbox"/> Temperature Change | <input type="checkbox"/> Other | |
| <input type="checkbox"/> Configuration Control | <input type="checkbox"/> Maintenance Work on Ventilation Systems | | <input type="checkbox"/> Utility Interruptions | | |
| WORK CONTROLS | | | | | |
| Work Practices | | | | | |
| <input checked="" type="checkbox"/> None | <input type="checkbox"/> Exhaust Ventilation | <input checked="" type="checkbox"/> Lockout/Tagout | <input type="checkbox"/> Spill Containment | <input type="checkbox"/> Security (see Instruction Sheet) | |
| <input checked="" type="checkbox"/> Back-up Person/Watch | <input type="checkbox"/> HP Coverage | <input type="checkbox"/> Posting/Warning Signs | <input type="checkbox"/> Time Limitation | <input type="checkbox"/> Other | |
| <input type="checkbox"/> Barricades | <input type="checkbox"/> IH Survey | <input type="checkbox"/> Scaffolding-requires inspection | <input type="checkbox"/> Warning Alarm (i.e. "high level") | | |
| Protective Equipment | | | | | |
| <input type="checkbox"/> None | <input type="checkbox"/> Ear Plugs | <input type="checkbox"/> Gloves | <input type="checkbox"/> Lab Coat | <input checked="" type="checkbox"/> Safety Glasses | |
| <input type="checkbox"/> Coveralls | <input type="checkbox"/> Ear Muffs | <input type="checkbox"/> Goggles | <input type="checkbox"/> Respirator | <input type="checkbox"/> Safety Harness | |
| <input type="checkbox"/> Disposable Clothing | <input type="checkbox"/> Face Shield | <input checked="" type="checkbox"/> Hard Hat | <input type="checkbox"/> Shoe Covers | <input checked="" type="checkbox"/> Safety Shoes | <input type="checkbox"/> Other |
| Permits Required (Permits must be valid when job is scheduled.) | | | | | |
| <input checked="" type="checkbox"/> None | <input type="checkbox"/> Cutting/Welding | <input type="checkbox"/> Impair Fire Protection Systems | | | |
| <input type="checkbox"/> Concrete/Masonry Penetration | <input type="checkbox"/> Digging/Core Drilling | <input type="checkbox"/> Rad Work Permit-RWP No | | | |
| <input type="checkbox"/> Confined Space Entry | <input type="checkbox"/> Electrical Working Hot | <input type="checkbox"/> Other | | | |
| Dosimetry/Monitoring | | | | | |
| <input checked="" type="checkbox"/> None | <input type="checkbox"/> Heat Stress Monitor | <input type="checkbox"/> Real Time Monitor | <input type="checkbox"/> TLD | | |
| <input type="checkbox"/> Air Effluent | <input type="checkbox"/> Noise Survey/Dosimeter | <input type="checkbox"/> Self-reading Pencil Dosimeter | <input type="checkbox"/> Waste Characterization | | |
| <input type="checkbox"/> Ground Water | <input type="checkbox"/> O ₂ /Combustible Gas | <input type="checkbox"/> Self-reading Digital Dosimeter | <input type="checkbox"/> Other Check O ₂ level prior to entry | | |
| <input type="checkbox"/> Liquid Effluent | <input type="checkbox"/> Passive Vapor Monitor | <input type="checkbox"/> Sorbent Tube/Filter Pump | | | |
| Training Requirements (List below specific training requirements) | | | | | |
| Confined Space, CA –Collider User, PHENIX Awareness | | | | | |
| Based on analysis above, the Walkdown Team determines the risk, complexity, and coordination ratings below: | | | If using the permit when all hazard ratings are low, only the following need to sign: (Although allowed, there is no need to use back of form) | | |
| ES&H Risk Level: | <input checked="" type="checkbox"/> Low | <input type="checkbox"/> Moderate | <input type="checkbox"/> High | WCC: | Date: |
| Complexity Level: | <input checked="" type="checkbox"/> Low | <input type="checkbox"/> Moderate | <input type="checkbox"/> High | Service Provider: | Date: |
| Work Coordination: | <input checked="" type="checkbox"/> Low | <input type="checkbox"/> Moderate | <input type="checkbox"/> High | Authorization to start | Date: |
| (Departmental Sup/WCC/Designee) | | | | | |

3. Both work requester and service provider contribute to work plan (use attachments for detailed plans)

| | | | | |
|--|---------------------|-------------------------------|--|-------------|
| Work Plan (procedures, timing, equipment, and personnel availability need to be addressed): See Attached Work Plan | | | | |
| Special Working Conditions Required: None | | | | |
| Operational Limits Imposed: Modification work limited to lower octants easily reachable when standing on lower magnet superstructure. | | | | |
| Post Work Testing Required: No | | | | |
| Job Safety Analysis Required: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No | | | Walkdown Required: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No | |
| Reviewed by: Primary Reviewer will determine the size of the review team and the other signatures required based on hazards and job complexity. Primary Reviewer signature means that the hazards and risks that could impact ES&H have been identified and will be controlled according to BNL requirements. | | | | |
| Title | Name (print) | Signature | Life # | Date |
| Primary Reviewer | | | | |
| ES&H Professional | | | | |
| Other | | | | |
| Other | | | | |
| Work Control Coordinator | | | | |
| Service Provider | | | | |
| Review Done: <input type="checkbox"/> in series | | <input type="checkbox"/> team | | |

4. Job site personnel fill out this section.

| | | | |
|---|--------|------------------------|--------|
| Note: Signature indicates personnel performing work have read and understand the hazards and permit requirements (including any attachments). | | | |
| Job Supervisor: | | Contractor Supervisor: | |
| Workers: | Life#: | Workers : | Life#: |
| | | | |
| | | | |
| Workers are encouraged to provide feedback on ES&H concerns or on ideas for improved job work flow. Use feedback form or space below. | | | |

5. Departmental Job Supervisor, Work Control Coordinator/Designee

| | | | |
|---|------------|--------|-------|
| Conditions are appropriate to start work: (Permit has been reviewed, work controls are in place and site is ready for job.) | | | |
| Name: | Signature: | Life#: | Date: |

6. Departmental Job Supervisor, Work Requester/Designee determines if Post Job Review is required. ☐ Yes ☐ No

| | | | |
|--|------------|--------|-------|
| Post Job Review (Fill in names of reviewers) | | | |
| Name: | Signature: | Life#: | Date: |
| Name: | Signature: | Life#: | Date: |

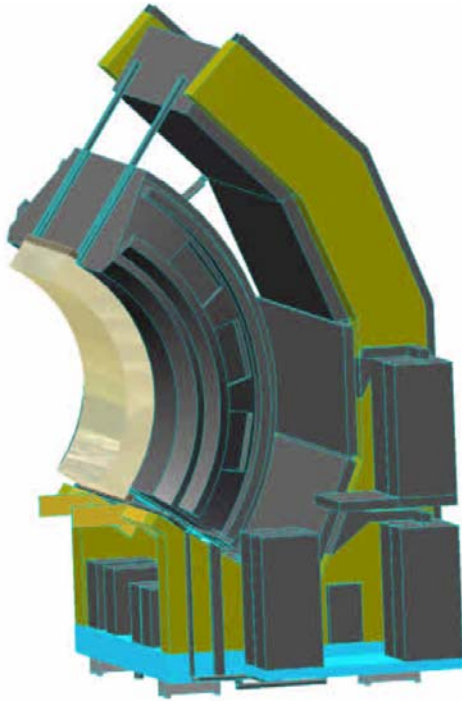
7. Worker provides feedback.

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| Worker Feedback (use attached sheets as necessary) a) WCM/WCC: Is any feedback required? <input type="checkbox"/> Yes <input type="checkbox"/> No b) Workers: Are there better methods or safer ways to perform this job in the future? <input type="checkbox"/> Yes <input type="checkbox"/> No |
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8. Closeout: Work Control Coordinator (authorizing dept.) checks quality of completed permit and ensures the work site is left in an acceptable condition. (WCC can delegate clean up of work area to work supervisor)

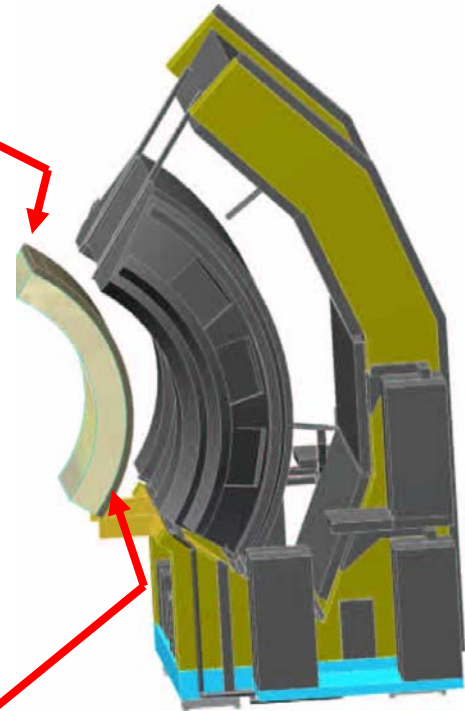
| | | | |
|-----------|------------|--------|-------|
| Name: | Signature: | Life#: | Date: |
| Comments: | | | |

Figure 1: FEM repairs needed on PC1 West



West Carriage with
DC/PC1 in run position

Upper South
FEM to be
replaced



Lower North
FEM to be
replaced

West Carriage with
DC/PC1 in open position

Figure 2: Drift Chamber Translation

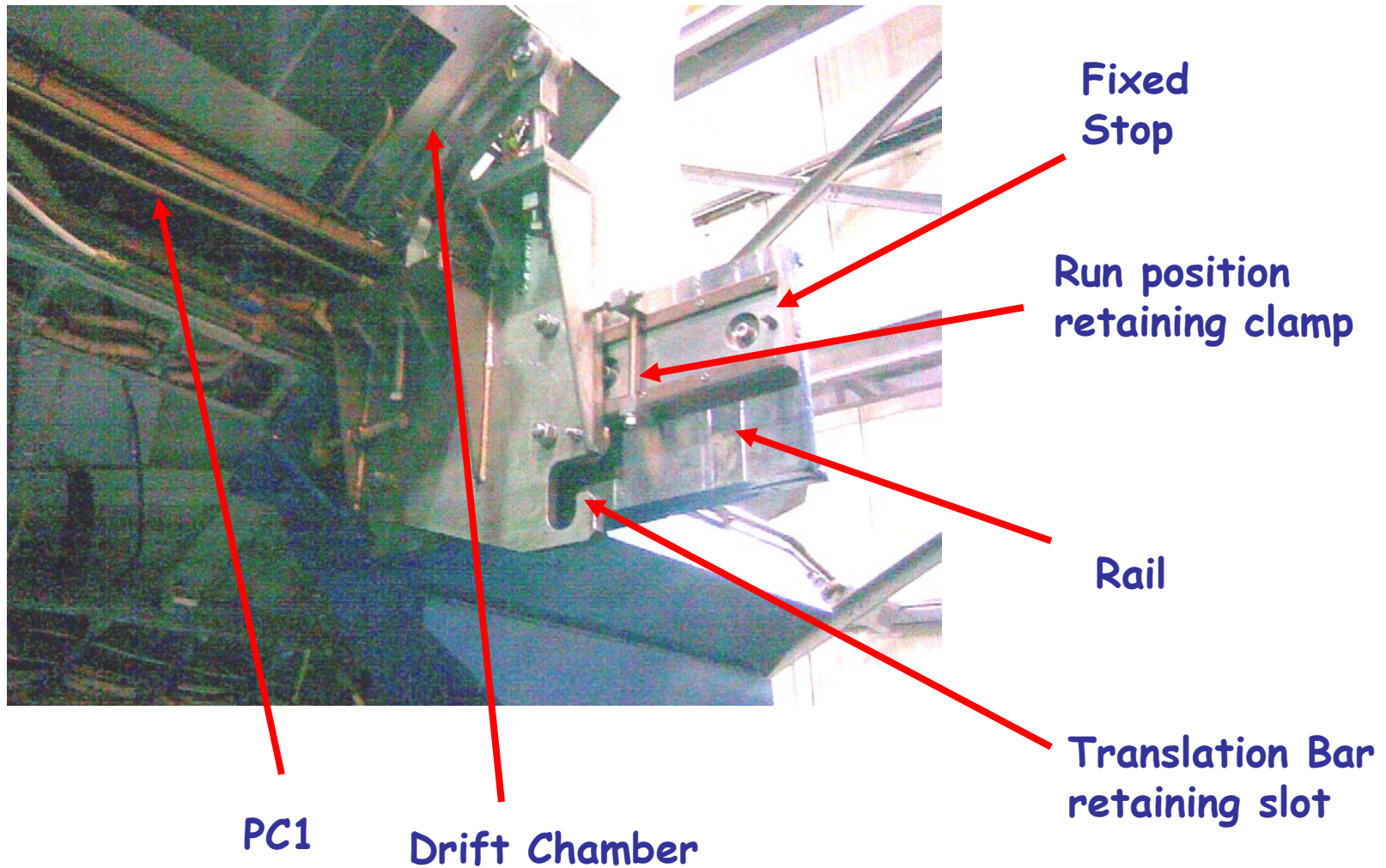
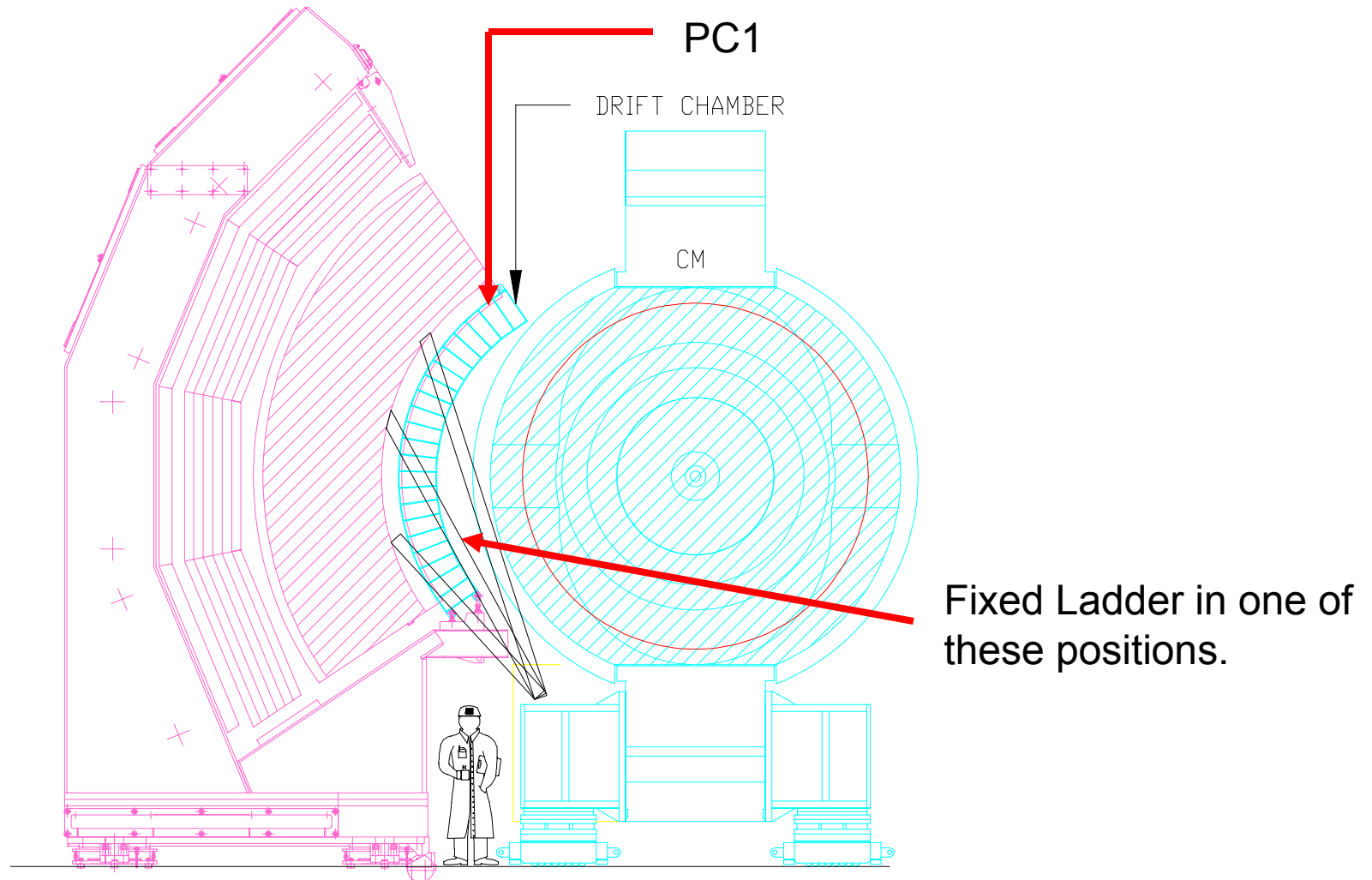


Figure 3: Upper FEM access plan



PC1W FEM repair in the PHENIX Experimental Hall (bldg. 1008).

Problem

A malfunctioning frontend module (FEM) in the PHENIX west Pad Chamber 1 (PC1W) at the bottom north end has necessitated repairs during the current shutdown. (see figure 1) The faults can be addressed by troubleshooting the offending FEM board which is accessible by pulling the West DC/PC1 out and arranging to get at it from a step ladder or fixed ladder.

There is also another FEM that has a lower priority need for replacement. This module is on the south end of PC1 near the top. Access to this FEM is difficult, as it is located 10 to 20 feet above track level, tucked inside the arc formed by the RICH detector, with the Central Magnet (CM) in front of the west carriage. The procedures described below were used successfully in the past to trouble shoot and repair failed modules in the RICH detector and Drift chamber wires, both of which have similar access difficulties. The procedure involves use of a fixed ladder secured to the body of the CM.

Work Plan

This work is to be done by fully trained and experienced personnel (PHENIX mechanical and electrical technicians and PC1 expert scientists) during the 2008 summer shutdown.

REF: PP-2.5.5.1-01 "Moving the Central Magnet and Detector Carriages in the PHENIX IR"

1. Preparation for repairs

- persons performing this work shall have PHENIX Awareness training, CA access training, BNL ladder training and (if working on the upper FEM in step 3) BNL working at heights training.
- Move the West carriage to its open (west-most) position and secure it at the position in accordance with PHENIX standard operating procedures.
- Move the CM to its normal (run) position and secure it in place in accordance with PHENIX standard operating procedures
- Ensure that power to the DC & PC1 electronics are secured and that the CM power key is locked out of use.

- The worker is to use a body harness with a short clip-on lanyard and tie off before starting work.
- A watch person must be present at all times when a person is on the ladders
- Remove or reinstall power supply modules as necessary.

2. Open the DC/PC1 West

- examine and evaluate the need to move, disconnect and/or reposition all wiring and piping to the DC/PC1 West to allow it to be moved approximately 10 inches towards the east, then move/disconnect/reposition as necessary.
- place a C-clamp on the DC/PC1 West roller track ~1/2 inch before the fixed stop pin that already exists on the track. (see figure 2)
- place the DC translation thrust bar in the thrust bar retaining slots.
- remove the run position retaining clamp
- carefully push the DC translation thrust bar eastward to slowly move the DC/PC1 approximately 10 inches until it contacts the C-clamp.
- Using another C-clamp secure the DC/PC1 in this position.

3. FEM troubleshooting and repair (lower north FEM)

Access to this area will require a short step ladder (~ 5 steps). The ladder shall be placed and secured directly below the FEM to be repaired. Use the step ladder to access and repair the FEM, adhering to all BNL ladder safety requirements.

During repairs and troubleshooting, power to PC1 electronics may be turned on to perform tests and verification of repairs. All work of this nature shall comply with electronics testing requirements for currents and voltages of exposed electrical connections as described in the PHENIX awareness training

4. FEM replacement (upper south FEM)

(Access to this modules is by extension ladders set up between the CM)outrigger and the RICH vessel on the west carriage. As flammable gas is not flowing anywhere in the IR during summer shutdown periods, there is no danger of a flammable gas mishap, and the location of the repairs is far enough removed from the DC, PC, and TEC gas windows that there is no chance of damage to the gas volume as a consequence of these repairs. The 12-ton building crane will be positioned such to place the eye of a sling directly above the work area, then locked out. A harness will be worn by the worker replacing this FEM and clipped to the sling while the work is being performed. A watch must be present at all times when someone is up on the ladders. All work in the IR will be supervised by Carter Biggs.)

- Erect and secure 1 (or 2 side by side if necessary) extension ladders between the top of the central magnet outrigger and the rich detector. (see figure 3)
- Set up a tie off point just above the working position using the building crane and an adequately rated sling.

- The position of the tie off point is to be set for each working level and the crane must be locked out before the worker ascends the ladder.
- remove and replace the target FEM
- test and verify operational performance for the replaced FEM. During tests and verification of repairs electronics may be turned on to as necessary. All work of this nature shall comply with electronics testing requirements for currents and voltages of exposed electrical connections as described in the PHENIX awareness training

5. Work conclusion

- remove ladders
- remove the clamp securing the DC in the open position.
- carefully push the DC translation thrust bar westward to slowly move the DC/PC1 approximately 10 inches until it contacts its run position stops.
- re-install the run position retaining clamp
- remove the east stop C-clamp
- remove the DC translation thrust bar from the thrust bar retaining slots and return it to storage for future use.
- restore all wiring and piping to its pre-repair condition

- The position of the tie off point is to be set for each working level and the crane must be locked out before the worker ascends the ladder.
- remove and replace the target FEM
- test and verify operational performance for the replaced FEM. During tests and verification of repairs electronics may be turned on to as necessary. All work of this nature shall comply with electronics testing requirements for currents and voltages of exposed electrical connections as described in the PHENIX awareness training

5. Work conclusion

- remove ladders
- remove the clamp securing the DC in the open position.
- carefully push the DC translation thrust bar westward to slowly move the DC/PC1 approximately 10 inches until it contacts its run position stops.
- re-install the run position retaining clamp
- remove the east stop C-clamp
- remove the DC translation thrust bar from the thrust bar retaining slots and return it to storage for future use.
- restore all wiring and piping to its pre-repair condition

Trouble shooting sequence for PC1 West Repairs

1. run DAQ on west arm as is to reproduce error.
2. remove the FEM for packet 4010 (the north bottom) which is first guess to be the bad FEM (unfortunately we can not rule out 4009 completely (the nearby first FEM in the multiplexed pair)) .
3. Run 4010 at an easily accessible place (bottom PC3W). If the error remains we know that this is the bad FEM.
4. Put a new one in the place of 4010. The new one should not be taken from our stock but take one that we have years of good function experience on PC3W.

If we can not reproduce the error or if we are in any sort of doubt, we replace both in the pair 4009/40010 with a pair from PC3W. We have spares to place on PC3W but we have too little running experience with them to put them at the difficult service places of PC1 so we prefer easily accessible PC3W.

5. The packet 4008 (south top), the one which once in a while (per mille level) gives parity error. I think the goal should be to have this swap done the first week so that we have the second week for me to take the working at heights training if it turns out to be necessary for (Anders) to go up and inspect. Also this FEM should be replaced with a known working one on PC3W.